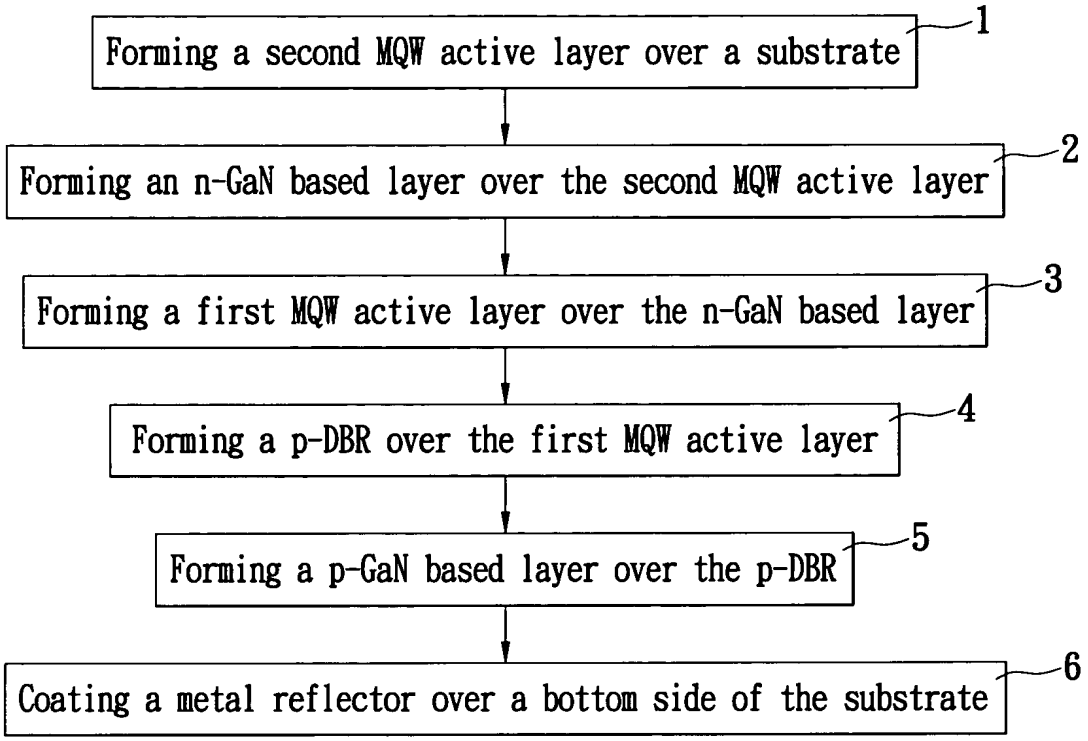

Forming a second MQW active layer over a substrate
1
Forming an n-GaN based layer over the second MQW active layer
2
Forming a first MQW active layer over the n-GaN based layer
3
Forming a p-DBR over the first MQW active layer
4
Forming a p-GaN based layer over the p-DBR
5
Coating a metal reflector over a bottom side of the substrate
6

FIG. 1

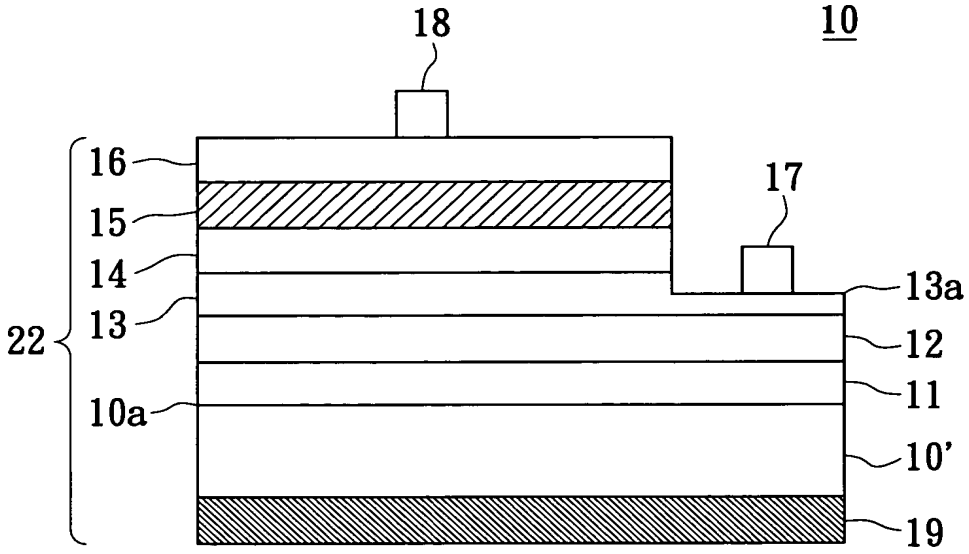

18
10
16
15
14
13
22
10a
17
13a
12
11
10'
19

FIG. 2

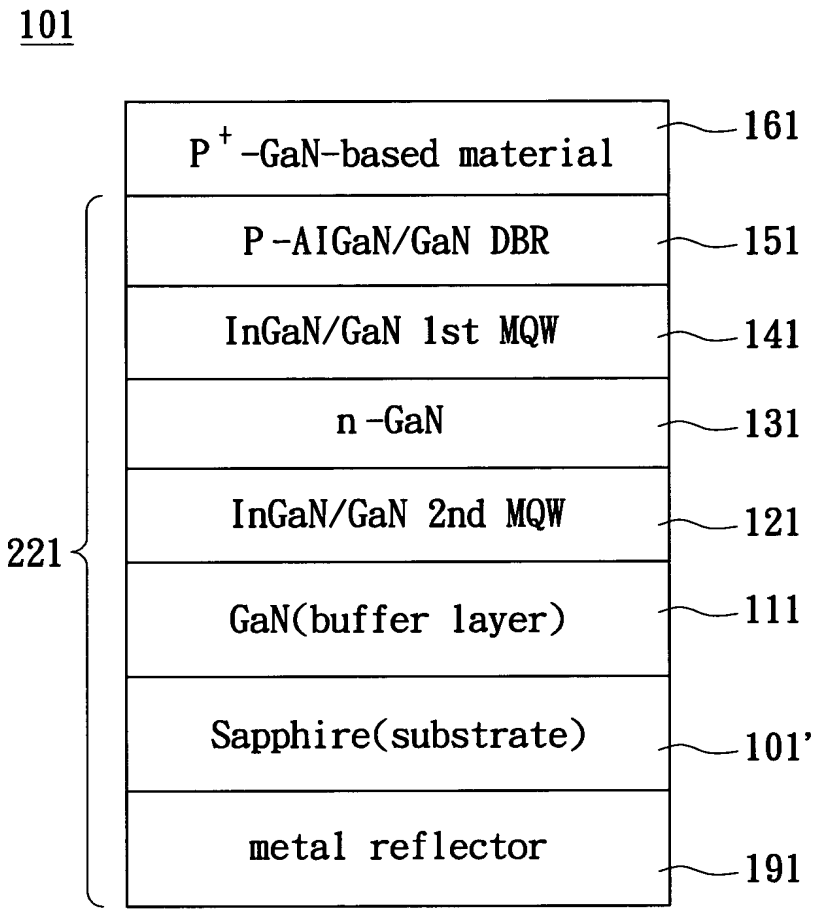

101
P+-GaN-based material
161
P-AlGaN/GaN DBR
151
InGaN/GaN 1st MQW
141
n-GaN
131
InGaN/GaN 2nd MQW
121
221
GaN(buffer layer)
111
Sapphire(substrate)
101'
metal reflector
191

FIG. 3

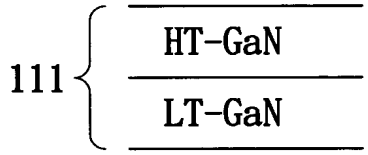
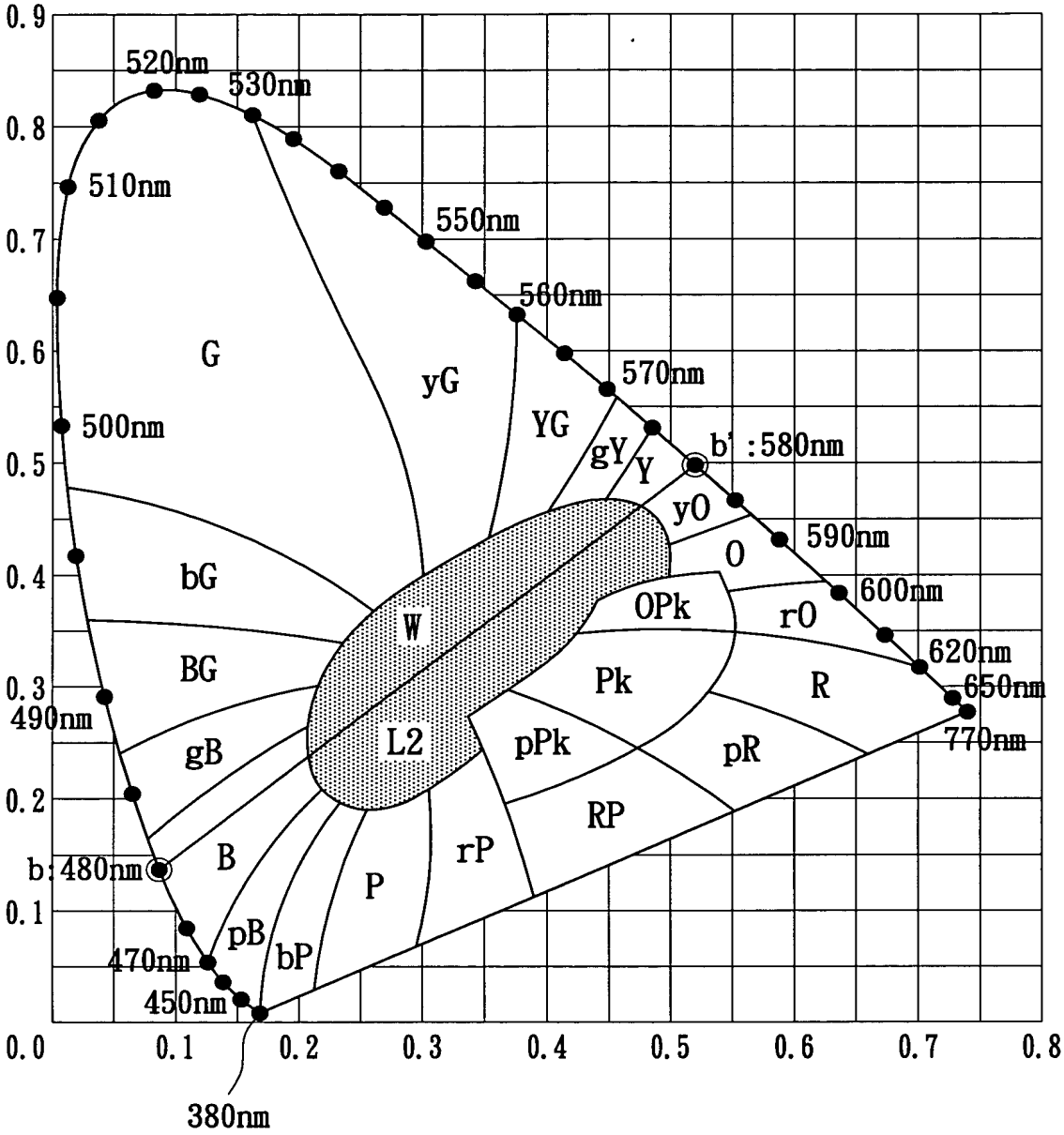

111
HT-GaN
LT-GaN

FIG. 3A



R:Red	O:Orange
B:Blue	P:Purple
G:Green	Pk:Pink
Y:Yellow	W:Write

FIG. 4

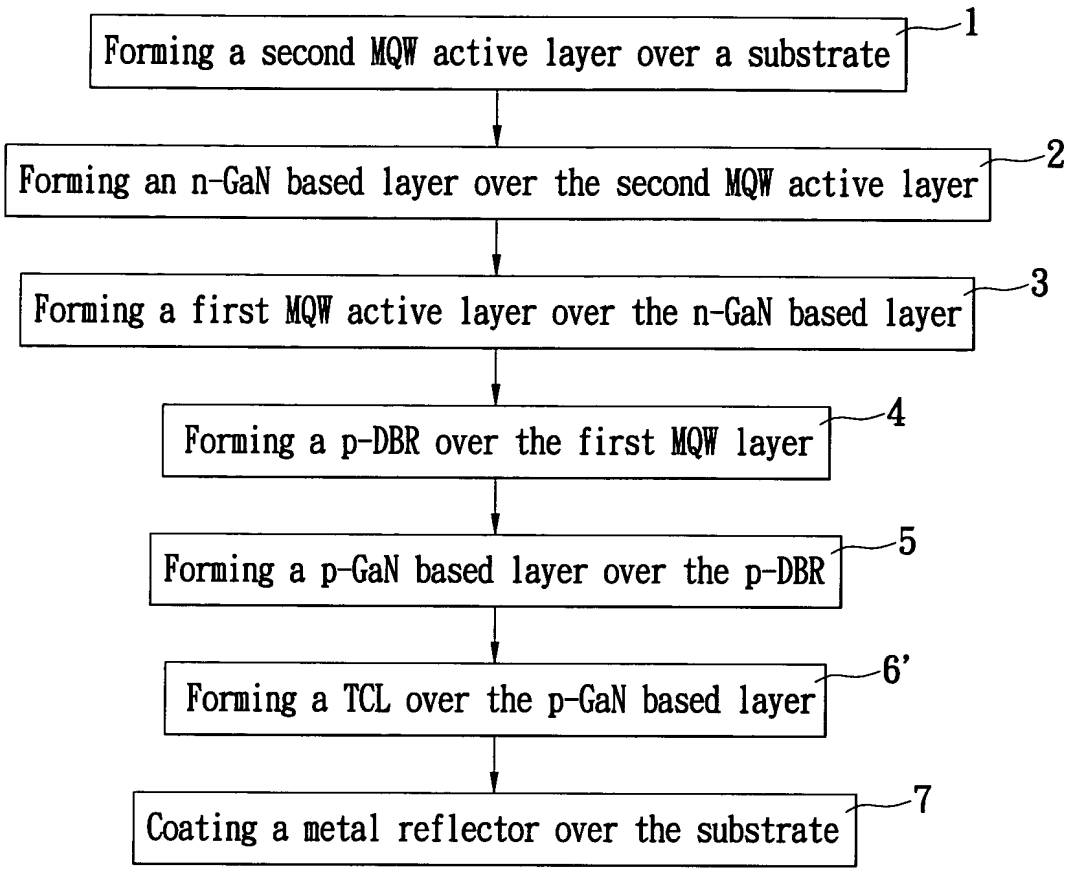

Forming a second MQW active layer over a substrate
1
Forming an n-GaN based layer over the second MQW active layer
2
Forming a first MQW active layer over the n-GaN based layer
3
Forming a p-DBR over the first MQW layer
4
Forming a p-GaN based layer over the p-DBR
5
Forming a TCL over the p-GaN based layer
6'
Coating a metal reflector over the substrate
7

FIG. 5

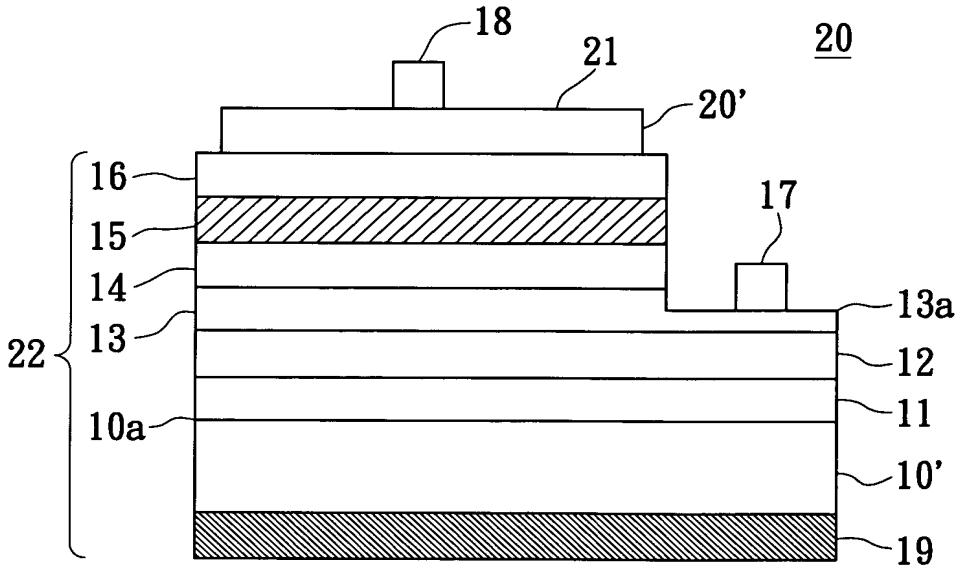

18
21
20
20'
16
17
15
14
13a
22
13
12
11
10a
10'
19

FIG. 6

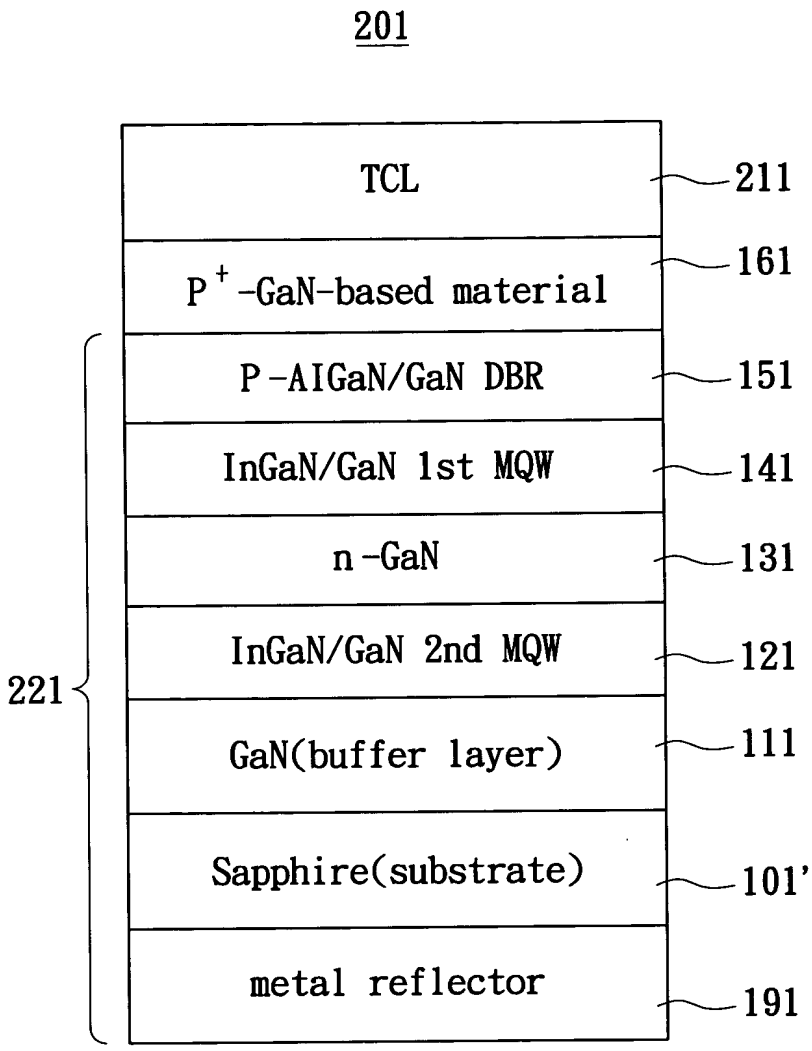

201
TCL
211
P+-GaN-based material
161
P-AlGaN/GaN DBR
151
InGaN/GaN 1st MQW
141
n-GaN
131
InGaN/GaN 2nd MQW
121
221
GaN(buffer layer)
111
Sapphire(substrate)
101'
metal reflector
191

FIG. 7

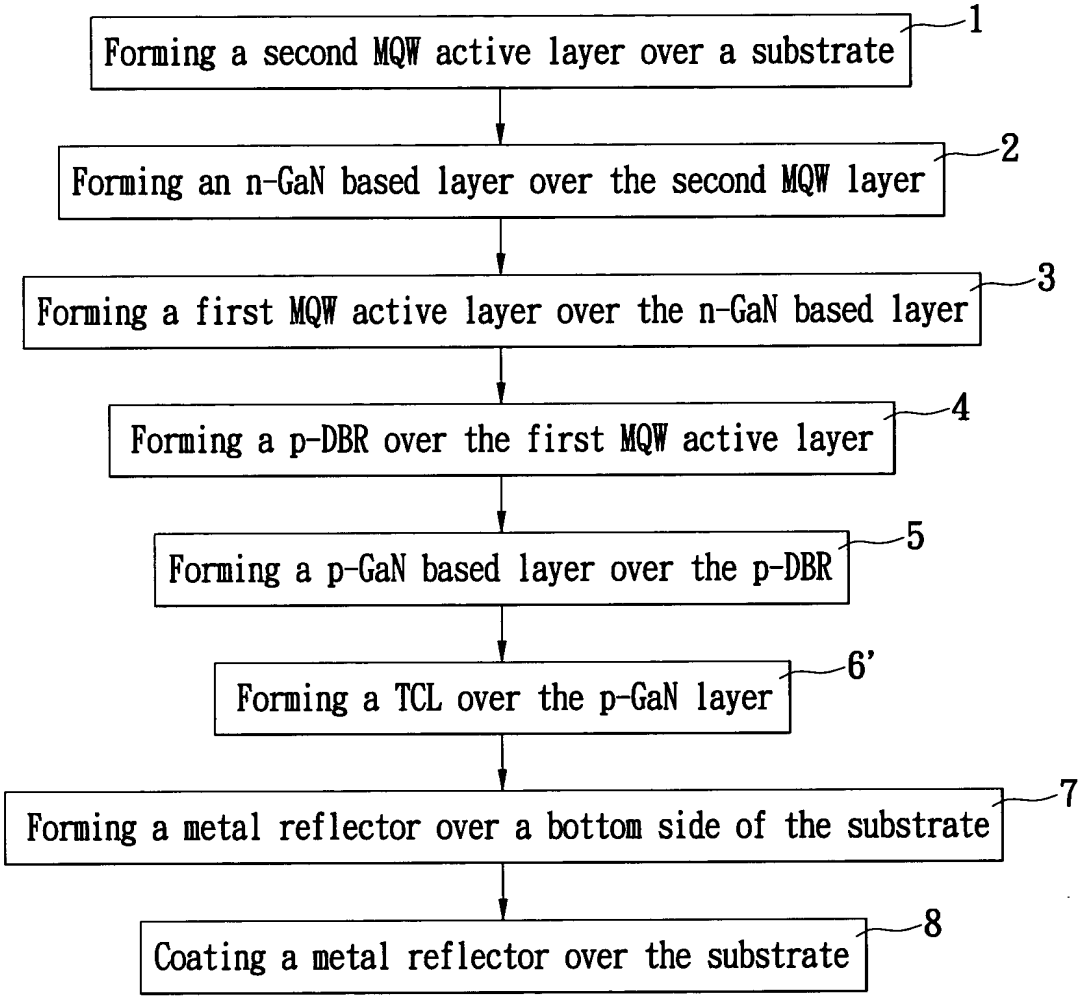

Forming a second MQW active layer over a substrate
1
Forming an n-GaN based layer over the second MQW layer
2
Forming a first MQW active layer over the n-GaN based layer
3
Forming a p-DBR over the first MQW active layer
4
Forming a p-GaN based layer over the p-DBR
5
Forming a TCL over the p-GaN layer
6'
Forming a metal reflector over a bottom side of the substrate
7
Coating a metal reflector over the substrate
8

FIG. 8

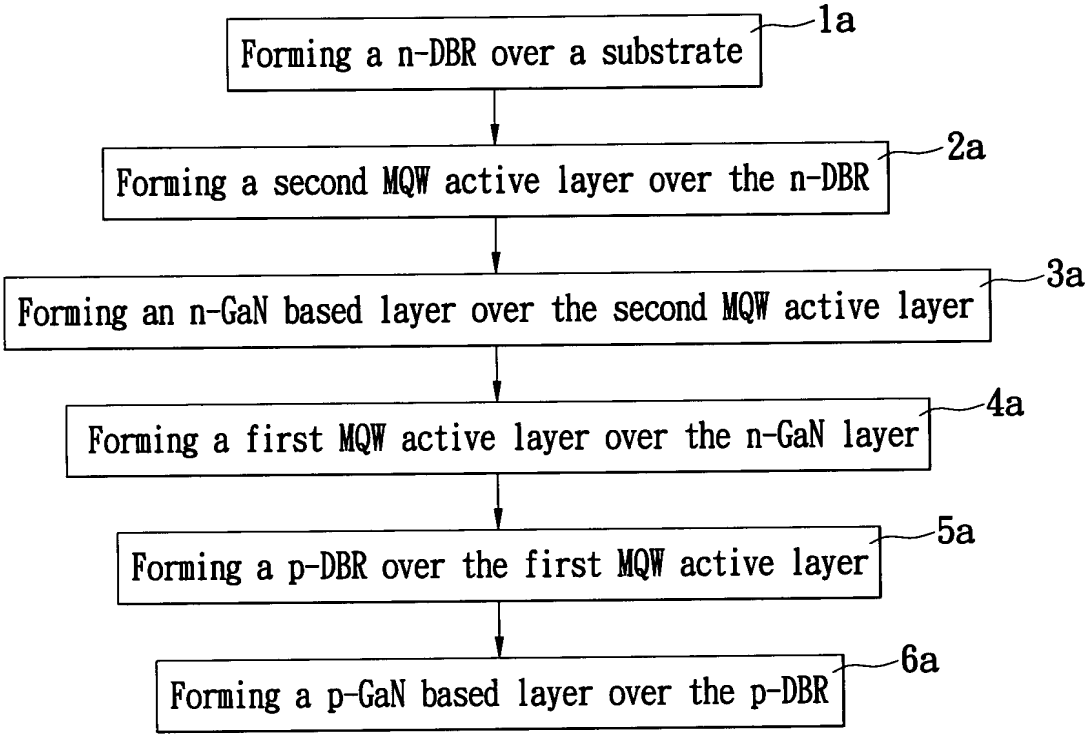

Forming a n-DBR over a substrate
1a
Forming a second MQW active layer over the n-DBR
2a
Forming an n-GaN based layer over the second MQW active layer
3a
Forming a first MQW active layer over the n-GaN layer
4a
Forming a p-DBR over the first MQW active layer
5a
Forming a p-GaN based layer over the p-DBR
6a

FIG. 9

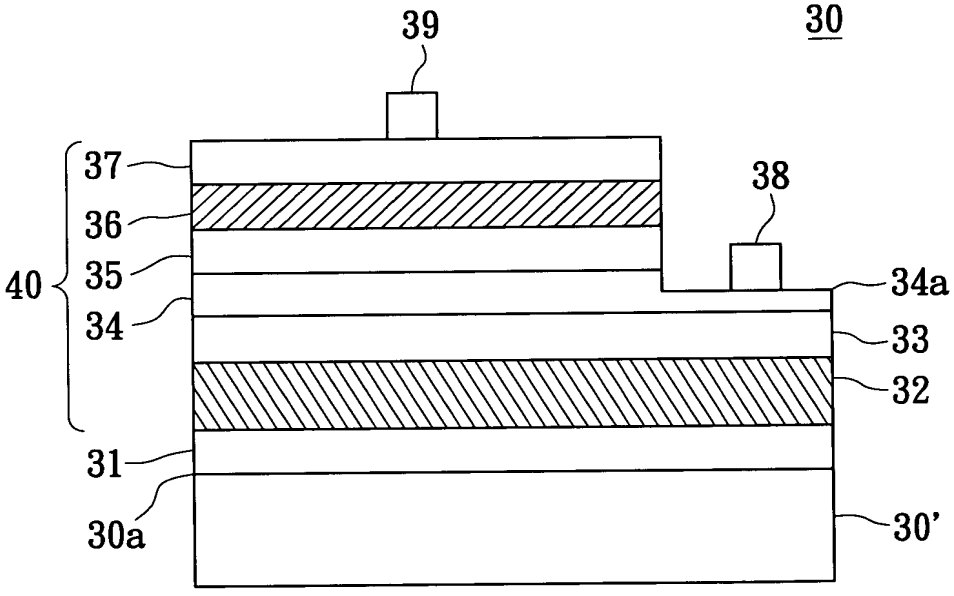

39
30
37
38
36
40
35
34a
34
33
32
31
30a
30'

FIG. 10

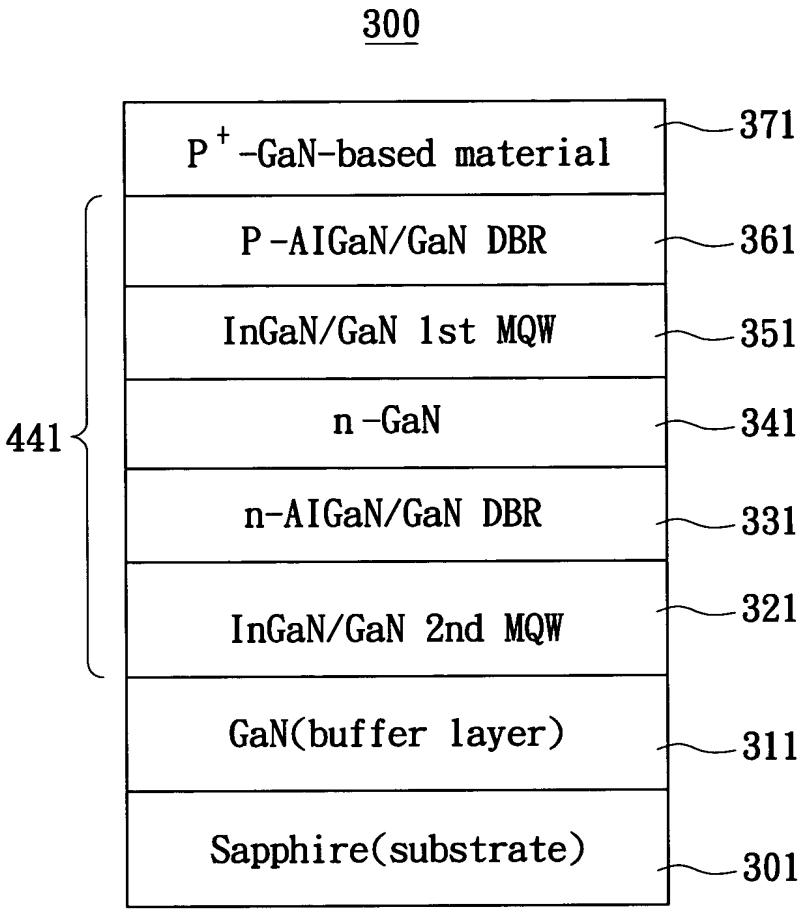


FIG. 11

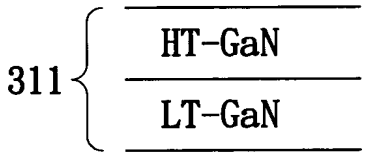


FIG. 11A

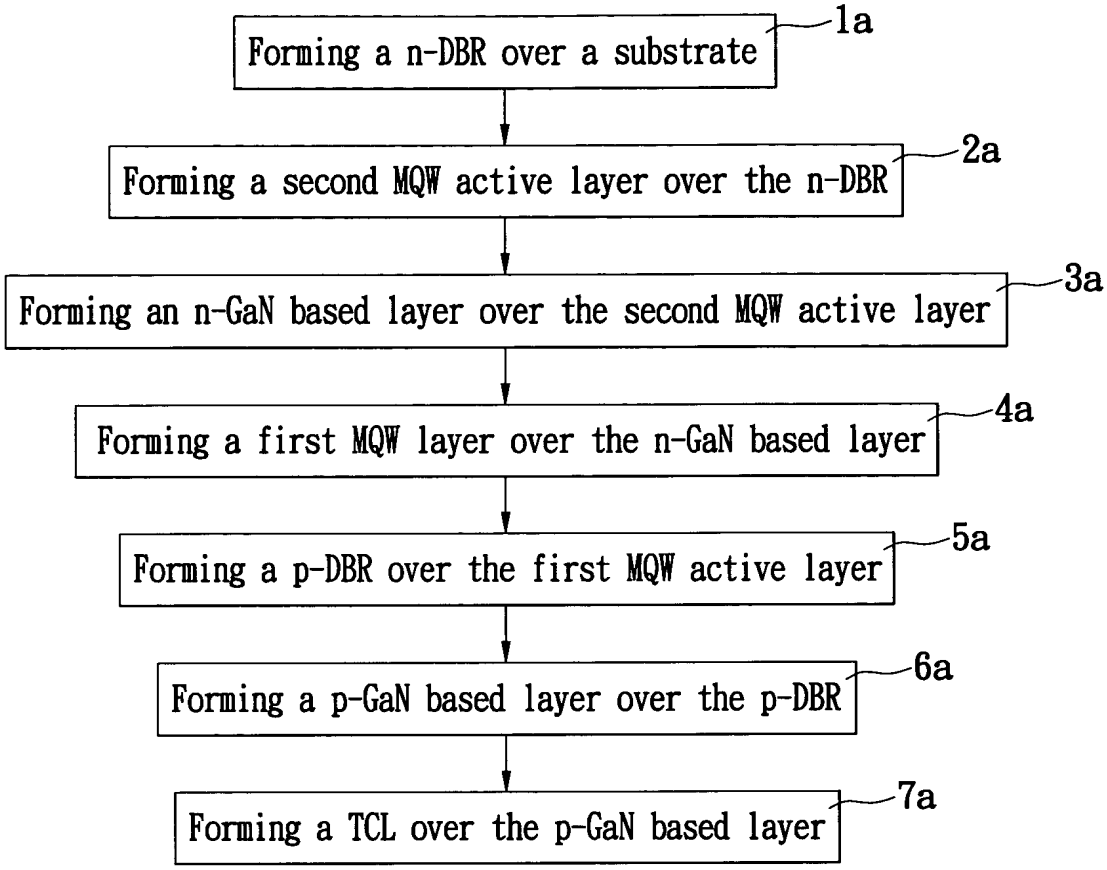

Forming a n-DBR over a substrate
1a
Forming a second MQW active layer over the n-DBR
2a
Forming an n-GaN based layer over the second MQW active layer
3a
Forming a first MQW layer over the n-GaN based layer
4a
Forming a p-DBR over the first MQW active layer
5a
Forming a p-GaN based layer over the p-DBR
6a
Forming a TCL over the p-GaN based layer
7a

FIG. 12

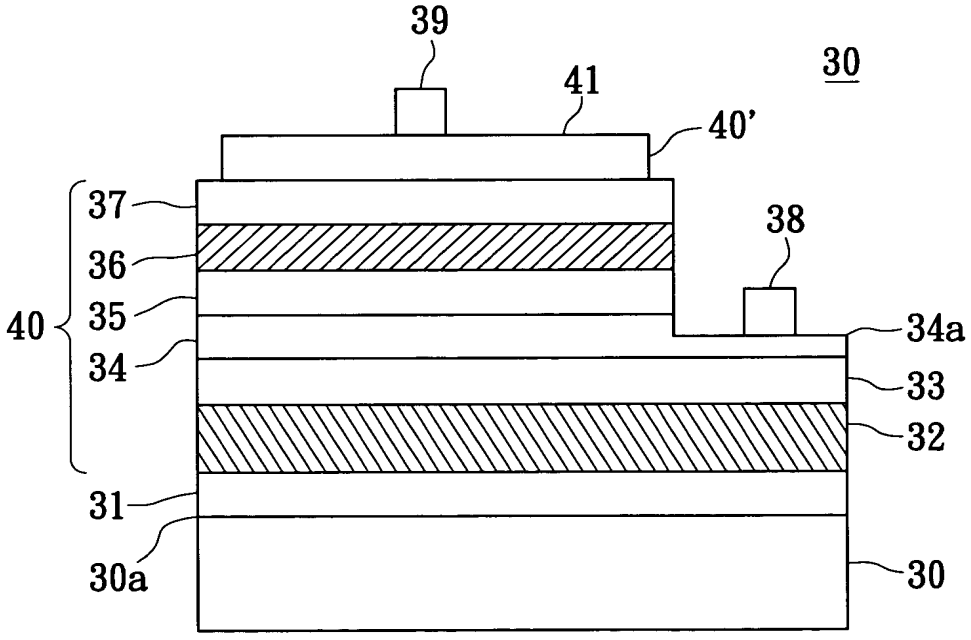

39
41
30
40'
37
38
36
40
35
34a
34
33
32
31
30a
30

FIG. 13

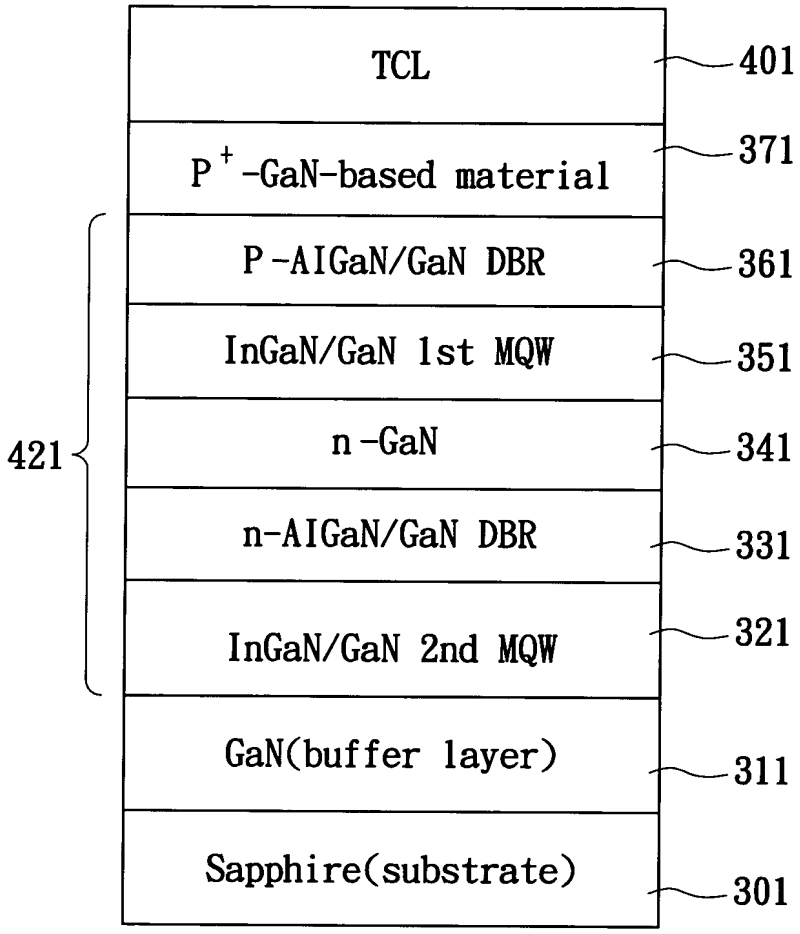

TCL
401
P+-GaN-based material
371
P-AlGaN/GaN DBR
361
InGaN/GaN 1st MQW
351
n-GaN
341
421
n-AlGaN/GaN DBR
331
InGaN/GaN 2nd MQW
321
GaN(buffer layer)
311
Sapphire(substrate)
301

FIG. 14

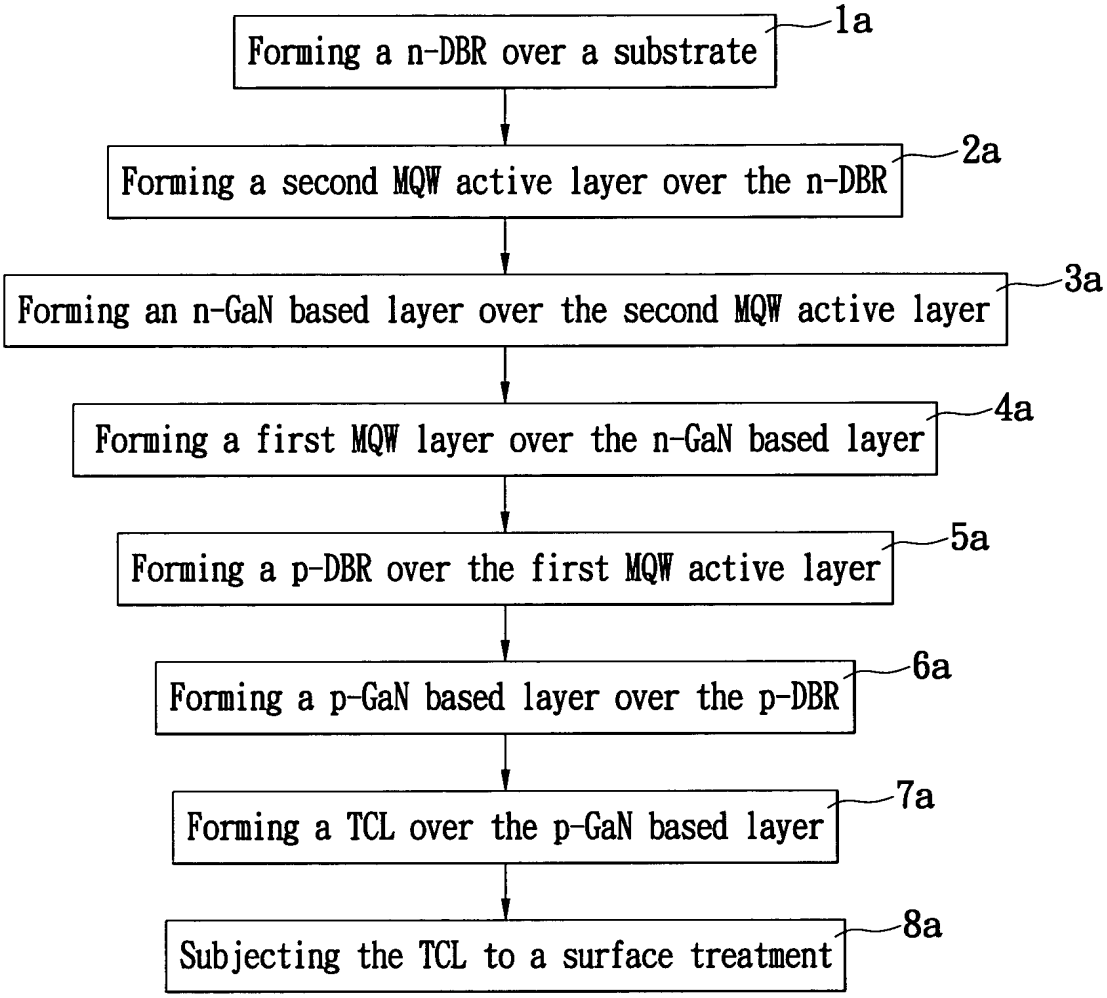
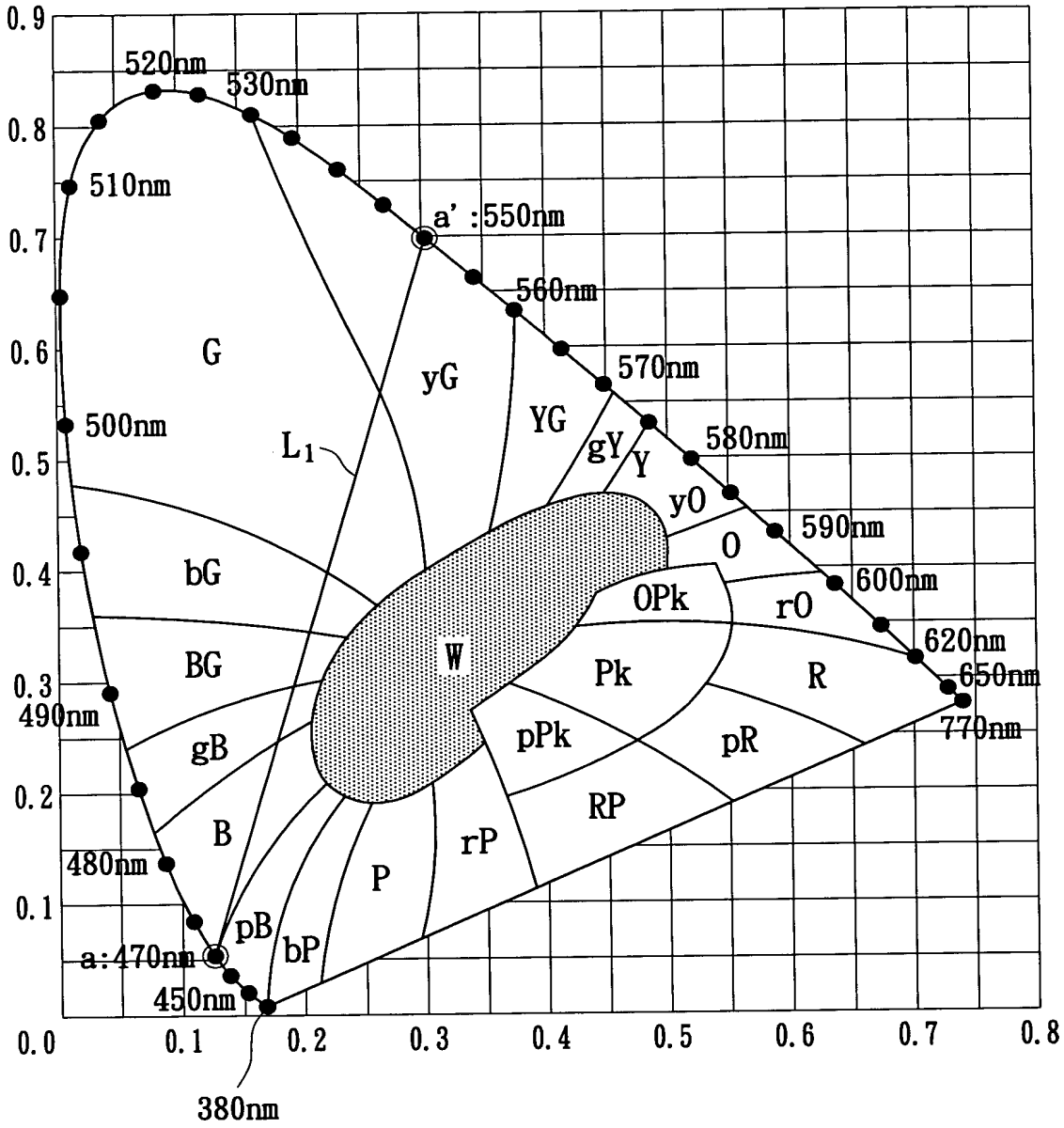

Forming a n-DBR over a substrate
1a
Forming a second MQW active layer over the n-DBR
2a
Forming an n-GaN based layer over the second MQW active layer
3a
Forming a first MQW layer over the n-GaN based layer
4a
Forming a p-DBR over the first MQW active layer
5a
Forming a p-GaN based layer over the p-DBR
6a
Forming a TCL over the p-GaN based layer
7a
Subjecting the TCL to a surface treatment
8a

FIG. 15



R:Red	O:Orange
B:Blue	P:Purple
G:Green	Pk:Pink
Y:Yellow	W:Write

FIG. 16